

Appl. No. 09/628,629  
Amendment dated July 20, 2005  
Reply to Office Action of April 22, 2005

Remarks

Claims 1 - 49 remain in the application for consideration. Reconsideration of the application is requested in view of the remarks appearing below herein.

1. Applicant notes with appreciation the allowance of claims 13 - 19, 30 - 34 and 45 - 49.

2. Claims 1, 20 and 35 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 6,337,645 ("Pflaumer") in view of U.S. Patent 5,148,278 ("Wischermann").

Applicant traverses this ground of rejection. The purposes of the methods of Pflaumer and Wischermann are very different from the purpose of applicant's method. The references, viewed individually or in combination, do not teach or suggest applicant's claimed subject matter in the manner required to properly support a rejection under Section 103.

The claimed method and apparatus of applicant are directed to the selective attenuation of corruption in a digital signal. Corruption can be introduced into a digital signal by the phenomenon known as "aliasing". For a discussion of this phenomenon see page 4, lines 21 -25. In particular, applicant's method is designed to attenuate aliasing artifacts that occur in digital images captured with a sensor that does not have a suitable anti-aliasing filter. The kind of artifact dealt with in

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applicant's method arises when the sampling rate of a signal is reduced (decimation or down-sampling) without the removal of high frequencies above the Nyquist frequency. These high frequencies "alias" to lower frequencies and corrupt the signal of interest. See the discussion extending from page 5, line 12 to page 6, line 5. In applicant's method the output signal is devoid of any aliasing artifacts which were already present in the input signal.

In the method of applicant the resolution of the digital input signal is first reduced to provide a reduced resolution signal that has fewer data samples, or points, than the input signal. The reduced resolution signal is then median filtered, i.e., for any one sample in the reduced resolution signal the median filter computes the median of its neighboring  $n$  samples and replaces the sample value with the median value, to provide a filtered reduced resolution signal. The filtered reduced resolution signal is then interpolated, that is, the number of data points is increased, to provide the digital output signal.

The process of decimation and interpolation reduces the computational complexity involved in the claimed method. See, for example, the discussion on page 17, lines 3 - 14.

On the other hand, the method of Pflaumer is aimed at audio signal processing. The key problem to which the method of Pflaumer is directed is distortion which arises in an audio signal from the fact that new frequencies are

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created above the original Nyquist frequency due to interpolation or up-sampling (see column 2, lines 5 - 18). This is in contrast to the artifacts dealt with in the method of applicant which, as discussed above, arise when the sampling rate of a signal is reduced due to decimation, or down-sampling, without the removal of high frequencies above the Nyquist frequency and these high frequencies "alias" to low frequencies. It is important to note that Pflaumer is interested in preventing distortion due to interpolation from occurring whereas applicant's method is concerned with removing distortion that has already occurred and is present in the signal.

The method of Pflaumer is generally described at column 3, lines 50 - 57 where it is stated

[T]he method includes the steps of converting the  
analog signal to a digital signal using an analog to digital converter, filtering the digital signal using a digital decimation filter having an associated frequency response and subsequently filtering the digital signal through an interpolation filter having an associated frequency response.

Thus, Pflaumer teaches a method wherein an audio signal is decimated, or down-sampled, followed by filtering the reduced resolution signal with a linear filter and subsequently interpolating the filtered signal with a linear filter.

That a linear filter is used in the method of Pflaumer to filter the digital signal is clearly apparent from the characterization of the filter by the patentee

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as having an associated frequency response. A non-linear filter can not be characterized as having an associated frequency response since it does not have a single, or unique, frequency response; the frequency response of a non-linear filter changes as the signal content changes. Pflaumer is interested in "... attenuating the digital signal in a frequency range generally corresponding to the transition band portion" (see column 3, lines 60 - 65), which can only be achieved by employing a linear filter.

The examiner has acknowledged that the method of Pflaumer does not involve the use of a non-linear filter and has relied upon Wischermann for its teaching of the use of a non-linear filter. The examiner has concluded that "...it would have been obvious to one skilled in the art to combine the teaching of Wischermann to that of Pflaumer because they are analogous in removing aliasing from a signal." This conclusion is not supportable from the facts of record.

Wischermann deals with filtering video signals, which are three dimensional signals, to "... suppress disturbing signals which occur most often in video signals that are received from a television broadcast or by reproduction from video tape or other records" (see column 1, line 67 to column 2, line 2). There is described a three dimensional, non-linear filter for this purpose. There is no mention of decimation or down-sampling of the signal. Consequently, there is no possibility of distortion arising due to the reduction of

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sampling rate of a signal, which is the problem addressed by the applicant's method. Interpolation is mentioned. However, contrary to applicant's method, where the interpolation is applied after the non-linear filtering, Wischermann's method requires the interpolation be applied before the non-linear filtering (see column 2, lines 50-53 and the description of Figs. 4 and 5 in column 6). Thus, this reference does not in any way teach or suggest the method and apparatus of applicant.

The examiner's assertion to the contrary notwithstanding, one skilled in the art would find no motivation or incentive in the teachings of the references to incorporate a non-linear filter in the method of Pflaumer.

The non-linearity of the median filter utilized by applicant precludes the analysis of this type of filter in the frequency domain. As mentioned previously, the median filter switches its behavior depending on the input signal. For instance, if a median filter is presented with a step-edge, as illustrated in Fig. 10 of the present application, the output signal is also a step-edge with no degradation and no attenuation of any frequency. All the frequencies in the input signal are reproduced in the output signal.

The method of Pflaumer could not achieve its desired result of preventing distortion due to interpolation (see, column 3, lines 41-47) if a median filter were to be substituted for the specified linear filter, i.e., a filter having an associated frequency response, since the

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median filter would not always attenuate the desired frequencies ("... attenuating the digital signal in a frequency range generally corresponding to the transition band portion"; see column 3, lines 63-65). Conversely, if a linear bandlimiting filter were to be substituted for the required median filter in the method and apparatus of applicant, the desired result of attenuating aliasing artifacts in the input signal without degrading the original signal could not be achieved.

In essence, to combine the teachings of the references in the manner asserted by the examiner would require taking the Wischermann teaching of the use of a non-linear filter out of the context in which it is taught. Such hindsight reconstruction of the prior art to support a rejection under Section 103 is impermissible. Further, to incorporate a non-linear filter into the method of Pflaumer would render the method of Pflaumer unfit for its stated purpose. Clearly, one skilled in the art would find no suggestion or incentive to make a substitution in the method of a reference which would render that method unfit for its intended purpose.

These references therefore do not properly support a rejection under 35 U.S.C. § 103. Reconsideration of this ground of rejection and withdrawal thereof are respectfully requested.

3. Claims 2, 3, 5 - 7, 12, 21 22, 24 - 36, 37 and 39 -41 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Pflaumer in view of Wischermann and

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further in view of U.S. Patent 5,623,317 ("Robinson et al.").

Applicant traverses this ground of rejection. These claims are each dependent upon a claim discussed above with respect to the Pflaumer and Wischermann references. It has been shown that the Pflaumer and Wischermann references do not teach or in any way suggest the advantageous method, apparatus or multi-resolution filter of applicant.

The disclosure of Robinson et al does not render the rejection any more effective. Robinson et al. describes a method and apparatus for combining video signals with key signals while maintaining the integrity of the video signal and minimizing the effect of alias components. As is illustrated in Fig. 1, the apparatus includes a low pass filter 13 and a high pass filter 15. An analyzer 16 on the output of the high pass filter detects whether there are any high frequency components which would otherwise cause alias components when the signal is decimated and if such high frequency components are present then low pass filtering occurs whereas if such high frequency components are not present then no unnecessary filtering occurs so as to maintain the integrity of the signal. In essence, the method of this reference utilizes a selective switch based on whether the signal includes components which will provide aliasing.

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This reference, like Pflaumer, is therefore concerned with preventing aliasing distortion from occurring in contrast to applicant's method which concerns the removal of aliasing distortion. Furthermore, all low and high pass filters employed by Robinson are linear filters. It should also be noted from Fig. 1 that the order of operations proposed by Robinson is interpolation 10 first, followed by linear filtering 13, followed by decimation 14 whereas applicant's method involves decimation first, followed by non-linear filtering, followed by interpolation. Those skilled in the art and knowing of the disclosures of these references would not be placed in possession of the presently claimed subject matter.

The comments made above apply to all the claims included in this ground of rejection and therefore all these claims are patentable over the disclosures of the references. In addition, claim 12 is also patentable because the references do not deal with a two dimensional signal as is recited in claim 12.

The examiner has stated

[R]egarding claim 12: The method wherein the digital input signal comprises a two-dimensional signal. It is inherent that the digital signal of Pflaumer is a two dimensional signal.

This statement is not correct. An audio signal, which is the type of signal dealt with in Pflaumer, is a one-dimensional signal.



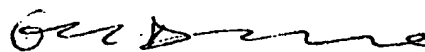
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Reconsideration of this ground of rejection and withdrawal thereof are respectfully requested.

4. Claims 4, 8 - 11, 23, 27 - 29, 38 and 42 - 44 have been objected to as being dependent upon a rejected base claim but indicated as being allowable if rewritten in independent form including all the limitations of the base claim and any intervening claim(s). These claims are all dependent upon at least one of the rejected claims discussed above. Since it has been shown that the rejected claims are patentable over the cited references, claims 4, 8 - 11, 23, 27 - 29, 38 and 42 - 44 are patentable in their present form.

In summary it has been shown that the claims are proper in form for allowance and in substance are directed to subject matter which is wholly novel and unobvious over the references of record. Reconsideration of the application and allowance of the claims are respectfully requested.

Respectfully submitted,

  
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